

# U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

**Scientific Name:**

Huperzia stemmermanniae

**Common Name:**

Wawae`iole

**Lead region:**

Region 1 (Pacific Region)

**Information current as of:**

05/09/2011

**Status/Action**

☐ Funding provided for a proposed rule. Assessment not updated.

☐ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

☐ New Candidate

☒ Continuing Candidate

☐ Candidate Removal

☐ Taxon is more abundant or widespread than previously believed or not subject

☐ Taxon not subject to the degree of threats sufficient to warrant issuance of

☐ Range is no longer a U.S. territory

☐ Insufficient information exists on biological vulnerability and threats to s

☐ Taxon mistakenly included in past notice of review

☐ Taxon does not meet the definition of "species"

☐ Taxon believed to be extinct

☐ Conservation efforts have removed or reduced threats

**Petition Information**

☐ Non-Petitioned

☒ Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

**For Petitioned Candidate species:**

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing?  
**Yes**

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, emergency listings, and essential litigation-related, administrative, and program management functions.

**Historical States/Territories/Countries of Occurrence:**

- **States/US Territories:** Hawaii
- **US Counties:** Hawaii, HI, Maui, HI
- **Countries:** United States

**Current States/Counties/Territories/Countries of Occurrence:**

- **States/US Territories:** Hawaii
- **US Counties:** Honolulu, HI, Maui, HI
- **Countries:**Country information not available

**Land Ownership:**

One population occurs on State land within Laupahoehoe Natural Area Reserve, and one population is on private land, both on the island of Hawaii. On Maui, one population occurred on Federal land in Kaapahu in Haleakala National Park.

**Lead Region Contact:**

ARD - Ecological Services, Marilet Zablan, 503-231-6158, marilet\_zablan@fws.gov

**Lead Field Office Contact:**

Pacific Islands ESFO, Christa Russell, (808) 792-9451, christa\_russell@fws.gov

**Biological Information**

**Species Description:**

*Huperzia stemmermanniae* is a pendant epiphytic clubmoss. Sterile stem bases are unforked or once-forked, short, usually much less than 6 inches (15 centimeters) long, green to pale yellow, with fertile terminal strobili. The strobili fork at an acute angle and the branches are usually straight (Palmer 2003, pp. 257-259).

## **Taxonomy:**

*Huperzia stemmermanniae* was first described as a species of *Phlegmariurus* by A.C. Medeiros and W.H. Wagner (Medeiros et al. 1996, pp. 90-96). Kartesz (1999) moved the species to the genus *Huperzia* and this species is recognized as a distinct taxon in the latest treatment of ferns and fern allies, Hawaii's Ferns and Fern Allies (Palmer 2003, pp. 257-259).

## **Habitat/Life History:**

This species is epiphytic on rough bark of living trees or fallen logs in mesic to wet *Metrosideros polymorpha*-*Acacia koa* (ohia-koa) forests on east Maui and the island of Hawaii, between 3,199 to 3,806 feet (ft) (975 to 1,160 meters (m)) in elevation (Medeiros et al. 1996, p. 93; Palmer 2003, pp. 257, 259; Hawaii Biodiversity Mapping Program (HBMP) 2006). *Huperzia stemmermanniae* has been reported growing on moss-covered logs of *Metrosideros* sp. and on *Syzygium sandwicensis* (ohia ha) trees. Associated native species include *Cheirodendron* spp. (olapa), *Cibotium* spp. (hapuu), *Cyrtandra* spp. (haiwale), *Ilex anomala* (kawau), *Melicope* spp. (alani), *Myrsine* spp. (kolea), *Psychotria* spp. (kopiko), and *Syzygium sandwicensis* (ohia ha) (Medeiros et al. 1996, p. 93).

## **Historical Range/Distribution:**

There is little information available on the historical range of this species. *Huperzia stemmermanniae* was first collected in 1981 from two populations totaling 10 individuals in Laupahoehoe Natural Area Reserve (NAR) on the island of Hawaii, initially identified as *H. mannii* (Medeiros et al. 1996, p. 93; HBMP 2008). In 1996 Medeiros et al. described *Huperzia stemmermanniae* as a distinct taxon (Medeiros et al. 1996, pp. 90-96). At that time it was known from Laupahoehoe NAR and Kaapahu on east Maui.

## **Current Range Distribution:**

Currently, this species is known from the Laupahoehoe NAR, and on private land, on the island of Hawaii, and from Kaapahu on east Maui (Hawaii Biodiversity and Mapping Program (HBMP) 2008; Perry 2006, in litt.).

## **Population Estimates/Status:**

Currently, *Huperzia stemmermanniae* is known from three populations, one on east Maui of one individual that has not been relocated since the late 1990s, and two on the island of Hawaii, totaling approximately 30 individuals (Medeiros et al. 1996, p. 93; Wood 2003, in litt.; Perry 2006, in litt.). There is one population in the State's Laupahoehoe NAR, east of Blair Road of 10 to 20 individuals (Perry 2006, in litt.; Wood 2003, in litt.). On east Maui, there was one individual in Kaapahu in Haleakala National Park, but this individual has not been relocated since 1995 (Welton 2008, in litt.). A survey was conducted in Opana Gulch in the Koolau Forest Reserve on Maui in 2007, but no individuals were found (Plant Extinction Prevention Program (PEPP) 2008, p. 67)

## **Threats**

### **A. The present or threatened destruction, modification, or curtailment of its habitat or range:**

The mesic to wet forest habitat of *Huperzia stemmermanniae* is highly and imminently threatened by feral pigs (*Sus scrofa*), goats (*Capra hircus*), cattle (*Bos taurus*), and axis deer (*Axis axis*) that degrade and destroy habitat (Medeiros et al. 1996, p. 96; Wood 2003, in litt.; HBMP 2008). Evidence of the activities of feral pigs has been reported at the Kaapahu and Laupahoehoe populations of *H. stemmermanniae* (Perlman 2010, in litt.; HBMP 2008). Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986, p. 121). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State (Tomich 1986, p. 125; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982, 408 pp.). This valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* to *Metrosideros polymorpha*. Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 in (20 cm), greatly disrupting the leaf litter and topsoil layers, contributing to erosion and changes in ground topography (Diong 1982, pp. 143-150). The feeding habits of pigs also created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava) (Diong 1982, pp. 164-165). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982, pp. 166-167). The effects on mesic and wet forest habitat by foraging of feral pigs have also been reported in fencing studies. In a fencing study conducted in the montane bogs of Haleakala, it was found that when feral pigs were fenced out of an area the cover of native plant species increased from 6 percent to 95 percent within six years of protection (Loope et al. 1991, pp. i, 13).

Feral goats are reported to be a threat to the dense koa forest habitat of *Huperzia stemmermanniae* on Maui and the island of Hawaii (Medeiros et al. 1996, p. 96). The goat is originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. The effects on mesic and wet forest habitat by the foraging of feral goats have been reported in fencing studies. An exclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of the native koa tree (Spatz and Mueller-Dombois 1973, p. 876). Another study at Puuwaawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, koa and *Metrosideros* spp. seedlings were observed germinating by the thousands (Department of Land and Natural Resources 2002, p. 52).

Feral cattle are reported to be a threat to the dense koa forest habitat of *Huperzia stemmermanniae* on Maui and the island of Hawaii (Medeiros et al. 1996, p. 96). Cattle, the wild progenitors of which were native to Europe, northern Africa, and southwestern Asia, were introduced to the Hawaiian Islands in 1793. Large feral herds developed as a result of restrictions on killing cattle decreed by King Kamehameha I. While small cattle ranches were developed on Kauai, Oahu, and west Maui, very large ranches of tens of thousands of acres were created on east Maui and Hawaii. Feral cattle can presently be found on the islands of Hawaii and Maui, and ranching is still a major commercial activity. Cattle eat native vegetation, trample roots and seedlings, cause erosion, create disturbed areas into which alien plants invade, and spread seeds of alien plants in their feces and on their bodies. The forest in areas grazed by cattle becomes degraded to grassland pasture, and plant cover is reduced for many years following removal of cattle from an area (Cuddihy and Stone 1990, pp. 59-63; Tomich 1986, pp. 140-150). Several alien grasses and legumes purposely introduced for cattle forage have become noxious weeds (Tomich 1986, p. 145; Cuddihy and Stone 1990, pp. 47, 61-62).

Evidence of the activities of axis deer has been reported at the Kaapahu population of *Huperzia stemmermanniae* (HBMP 2008). Axis deer were introduced to Maui in 1959, with five being released east of Kihei. By 1968, the Maui population was estimated to be 85 to 90 animals and currently there is concern that their numbers could expand to 15,000 to 20,000 or more within a few years (Waring 1996, p. 2; Nishibayashi 2001, in litt.; Anderson 2001, in litt.). They trample roots and seedlings, cause erosion, and promote the invasion of alien plants (Cuddihy and Stone 1990, pp. 66-67).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs and other introduced ungulates (Loope et al. 1991, p. 3). As an epiphytic species, *Huperzia stemmermanniae* is provided some degree of protection from ground disturbance by feral ungulates (Medeiros et al. 1996, p. 96); however, because of the extent of demonstrated habitat modifications, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants caused by feral pigs, goats, cattle, and deer, the Service believes they are threats to *H. stemmermanniae*.

## **B. Overutilization for commercial, recreational, scientific, or educational purposes:**

None known.

## **C. Disease or predation:**

Predation by feral pigs, goats, cattle, and axis deer is a potential threat to *Huperzia stemmermanniae*. Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Merlin and Juvik, p. 597). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990, pp. 63-67; Loope et al. 1991, p. 1,472). In a study conducted in the 1980s, feral pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982, p. 138). A stomach content analysis in this study showed that the pigs' food sources consisted of native plants, 60 percent of which was tree ferns (*Cibotium* spp.), alternating with *Psidium cattleianum* (strawberry guava) when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species, with larger trees killed over a few months of repeated feeding (Diong 1982, pp. 138, 144). The ability of cattle to degrade native vegetation by grazing and trampling was recognized very soon after large-scale ranching began in Hawaii (Cuddihy and Stone 1990, pp. 59-63).

Feral goats eat native vegetation, are able to forage in extremely rugged terrain, and have a high reproductive capacity (Clarke and Cuddihy 1980, p. C20; van Riper and van Riper 1982, pp. 34-35; Scott et al. 1986, pp. 352-358; Tomich 1986, pp. 150-156; Culliney 1988, pp. 336-337; Cuddihy and Stone 1990, p. 64). Elimination of rare native plants such as *Argyroxiphium kauense* and *A. sandwicense* ssp. *sandwicense* (Hawaiian silverswords), *Canavalia kauensis* (awikiwiki), and a number of Maui species (*Stenogyne microphylla*, *Schiedea haleakalaensis*, *Plantago princeps*), from areas heavily foraged by goats has been documented (Cuddihy and Stone 1990, p. 64).

Deer are primarily grazers, but also browse numerous plant species including those grown as commercial crops. Damage to crops by the foraging of feral deer, costing farmers thousands of dollars in revenue, has been documented on Maui (Waring 1996, pp. 3-4; Simpson 2001, in litt.).

As an epiphytic species (reported to grow on upright native trees as well as on fallen logs), *Huperzia stemmermanniae* may be afforded some degree of protection from these ground disturbing mammals because individuals of this species may be unreachable by these animals (Medeiros et al. 1996, p. 96). However, even though there are no observations of browsing for this species, predation by feral pigs, goats, cattle, and axis deer is a potential threat to this species.

## **D. The inadequacy of existing regulatory mechanisms:**

*Huperzia stemmermanniae* currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pig, goat, and deer hunting is allowed year-round, or during certain months, depending on the area (Hawaii

Department of Land and Natural Resources 1999, 2003); however, public hunting does not adequately eliminate the threats posed by ungulates to native plant species (Hawaii Heritage Program 1990, p. 3). Hunting of feral cattle is no longer allowed in Hawaii (Hawaii Department of Land and Natural Resources 1985) except under permitted conditions.

## **E. Other natural or manmade factors affecting its continued existence:**

*Huperzia stemmermanniae* is highly threatened by nonnative plants that degrade and destroy the forest habitat that supports the native species upon which this epiphytic plant grows (Medeiros et al. 1996, p. 96; HBMP 2008; Perry 2006, in litt.). With only three populations totaling 30 individuals on two islands, reduced reproductive vigor and extinction due to randomly occurring events, such as hurricanes, are also a potential threat to this species (Mangel and Tier 1994, pp. 607, 612; Pimm et al. 1998, pp. 757-758, 777).

The nonnative plant species that are threats to *Huperzia stemmermanniae* include *Sphaeropteris cooperi* (Australian tree fern), *Paspalum conjugatum* (Hilo grass), *Psidium cattleianum* (strawberry guava), and *Rubus argutus* (prickly Florida blackberry) at the east Maui populations; and *Psidium cattleianum* and *Clidemia hirta* (Koster's curse) at the Hawaii island populations (Medeiros et al. 1996, p. 96; HBMP 2008; Perry 2006, in litt.).

*Clidemia hirta* is a noxious shrub first cultivated on Oahu prior to 1941. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a serious plant threat (Wagner et al. 1985, p. 41; Smith 1989, p. 189). The most promising biological control to date for Koster's curse is the *Colleotrichum* fungus, *Gloesporioides* f. sp. *clidemiae*, released in 1986. Although there is no quantitative data available, it has an observable negative impact. Other agents tested were a moth (*Antiblemma acclinalis*), a leaf-feeding beetle (*Lius poseidon*), a fruit and flower-feeding insect (*Mompha trithalama*), and a terminal growth-feeding insect (*Liothrips urichi*), all with lesser control success than the fungus (Smith 1989, p. 189).

*Paspalum conjugatum* is a grass native to the Neotropics, and was introduced for cattle fodder and quickly spread (Cuddihy and Stone 1990, pp. 82-83.). It is naturalized in moist to wet disturbed sites along roadsides and in open fields (O'Connor 1999, p. 1,576). It forms a dense ground cover even on acidic, low-nutrient soils (Pacific Island Ecosystems at Risk 2006). Its small hairy seeds are easily transported on humans and animals or are carried by the wind through native forests. No biological control agents have been released for this species (University of Hawaii 2006).

*Psidium cattleianum*, a tree native to tropical America, has become widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, *P. cattleianum* develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985, p. 200; Wagner et al. 1985, pp. 40-41). A biological control agent, *Tectococcus ovatus*, has undergone 15 years of testing, and there is a proposal to release this insect at Olaa Forest Reserve (ScienceDaily 2008).

*Rubus argutus* is native to the central and eastern United States, and is a serious weed that naturalizes in a variety of disturbed habitats (Tunison 1991, p. 2). It reproduces both vegetatively and by seed. *Rubus argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Wagner et al. 1999a, p. 1,107; Tunison 1991, p. 3). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986, p. 53).

*Sphaeropteris cooperi*, a tree fern native to Australia, is used in landscaping in Hawaii because it is faster growing and more tolerant of warmer, drier conditions than the native Hawaiian tree ferns (Medeiros et al. 1992, pp. 30-31). It can achieve high densities in native Hawaiian forests, grows up to 1 ft (0.3 m) in height

per year with maximum known heights of 39 ft (12 m) (Jones and Clemesha 1981, pp. 56-57), and can displace native species. Understory disturbance by pigs facilitates the establishment of *S. cooperi* (Medeiros et al. 1992, pp. 30-32). This species has been known to spread over seven miles (12 kilometers) by windblown dispersal of spores from plant nurseries (Medeiros et al. 1992, pp. 28-31; Palmer 2003, p. 245).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 species are pests (Smith 1985, p. 180; Wagner et al. 1999a, p. 45). Confirmed personal observations (Medeiros et al. 1996, p. 96; HBMP 2008; Perry 2006, in litt.) and several studies (Cuddihy and Stone 1990, p. 74; Robichaux et al. 1998, p. 4) indicate nonnative plant species may outcompete native plants that support individuals of the epiphytic *Huperzia stemmerrmanniae*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smith 1985, pp. 240-241; Loope and Medeiros 1992, pp. 7-8; Medeiros et al. 1992, p. 30; Ellshoff et al. 1995, pp. ii, 3-4; Meyer and Florence 1996, p. 778; Medeiros et al. 1997, pp. 23-24; Loope et al. 2004, p. 1,472). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74; Vitousek et al. 1997, pp. 6-10). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the mesic to wet *Metrosideros polymorpha*-*Acacia koa* habitat of *H. stemmerrmanniae*, the Service believes nonnative plant species are a threat to this species.

### **Conservation Measures Planned or Implemented :**

This species is represented in two ex situ collections, one at Lyon Arboretum, the other at the Volcano Rare Plant Facility (Sugii 2006, in litt.; Perry 2006, in litt.). No other known conservation measures have been implemented for this species.

### **Summary of Threats :**

Based on our evaluation of habitat degradation and loss by feral pigs, goats, cattle, axis deer, and nonnative plants we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of the native plant species that provide physical support for individuals of the epiphytic *Huperzia stemmerrmanniae* due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by ungulates is a potential threat to this species. The small number of remaining individuals and limited range make this species susceptible to randomly occurring natural events such as hurricanes. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

### **For species that are being removed from candidate status:**

\_\_\_\_\_ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

### **Recommended Conservation Measures :**

- Control ungulates
- Control alien plants

- Continue collection for ex situ genetic storage and reintroduction
- Survey for populations at known locations and in suitable habitat
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species

## Priority Table

Magnitude	Immediacy	Taxonmomy	Priority
<b>High</b>	<b>Imminent</b>	Monotypic genus	1
		<b>Species</b>	<b>2</b>
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

### Rationale for Change in Listing Priority Number:

#### Magnitude:

This species is highly threatened by feral pigs, goats, cattle, and axis deer that degrade and/or destroy habitat and nonnative plants that compete with the native species (that support this epiphytic plant) for light, space, and nutrients. This species is potentially threatened by predation by nonnative ungulates, and by randomly occurring events, such as hurricanes. Threats to the mesic to wet forest habitat of *Huperzia stemmermanniae*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication.

#### Imminence :

Threats to *Huperzia stemmermanniae* from feral pigs, goats, cattle, deer, and nonnative plants are imminent because they are ongoing. Potential threats from predation by nonnative ungulates and randomly occurring events such as hurricanes are considered nonimminent.

☐ Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

### Emergency Listing Review

☐ No Is Emergency Listing Warranted?

The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine



listing process. *Huperzia stemmermanniae* is represented in ex situ collections. If it becomes apparent that the routine listing process is not sufficient to prevent further losses that may result in this subspecies' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *H. stemmermanniae* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

## **Description of Monitoring:**

The information in this form is based on the results of two meetings of 20 botanical experts held by the Center for Plant Conservation in December 1995 and November 1996. We incorporated additional new information on this species from information in our files and from Hawaii's Ferns and Fern Allies (Palmer 2003). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife (DOFAW); Joel Lau, Hawaii Natural Heritage Program; Arthur Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new status or range information was provided. In 2005 we contacted species experts, but received no new information on this taxon. In 2006 new status and range information was provided by Lyman Perry, Hawaii Division of Forestry and Wildlife; Hank Oppenheimer, Plant Extinction Prevention Program; and Nellie Sugii, Lyon Arboretum, and was incorporated into this assessment. In 2008, we received status information from Patti Welton, National Park Service. In 2009 we did not receive new information. In 2010, we received new information from Steve Perlman, National Tropical Botanical Garden. In 2011, we contacted the species experts listed below, and received no new information.

List all experts contacted:

Name Date Affiliation

Agorastos, Nick 02/16/11 Division of Forestry and Wildlife, Hawaii  
Bakutis, Ane 02/16/11 Plant Extinction Prevention Program, Molokai  
Ball, Donna 02/16/11 U.S. FWS, Partners Program, Hawaii  
Bily, Pat 02/16/11 The Nature Conservancy, Maui  
Bio, Kealii 02/16/11 Plant Extinction Prevention Program, Hawaii  
Caraway, Vickie 02/22/11 Hawaii Division of Forestry and Wildlife, Oahu  
Ching, Susan 02/16/11 Plant Extinction Prevention Program, Oahu  
Clark, Michelle 02/16/11 U.S. FWS, Partners Program, Kauai  
Duvall, Fern 02/16/11 Hawaii Division of Forestry and Wildlife, Maui  
Fay, Kerri 02/16/11 The Nature Conservancy, Maui  
Garnett, Bill 02/16/11 National Park Service, Kalaupapa, Molokai  
Haus, Bill 02/16/11 National Park Service, Haleakala NP, Maui  
Higashino, Jennifer 02/16/11 U.S. FWS, Partners Program, Maui  
Imada, Clyde 02/16/11 Bishop Museum, Botany Department  
Kawelo, Kapua 02/16/11 U.S. Army, Environmental Division  
McDowell, Wendy 02/16/11 Plant Extinction Prevention Program, Kauai  
Medeiros, Arthur 02/16/11 U.S. Geological Survey  
Moses, Wailana 02/16/11 The Nature Conservancy, Molokai  
Oppenheimer, Hank 02/16/11 Plant Extinction Prevention Program, Maui Nui  
Perlman, Steve 02/16/11 National Tropical Botanical Garden  
Perry, Lyman 02/16/11 Division of Forestry and Wildlife, Hawaii  
Pratt, Linda 02/16/11 U.S.G.S., Biological Resources Division  
Starr, Forest 02/16/11 U.S. Geological Survey  
Stevens, Bryon 02/16/11 DLNR Natural Area Reserves, Maui  
Ward, Joe 02/22/11 Puu Kukui Watershed Preserve  
Welton, Patti 02/16/11 National Park Service, Haleakala NP, Maui  
Wysong, Michael 02/16/11 DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (could be considered at risk) by Wagner et al. (1999b, p. 57). *Huperzia stemmermanniae* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell et al. 2005, p. B 7).

**Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:**

none

**Indicate which State(s) did not provide any information or comment:**

Hawaii

**State Coordination:**

On January 13, 2011, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. No additional information or comments were received.

**Literature Cited:**

Clarke, G., and L.W. Cuddihy. 1980. A botanical reconnaissance of the Na Pali coast trail: Kee Beach to Kalalau Valley (April 9-11, 1980). Division of Forestry and Wildlife, Department of Land and Natural Resources, Hilo, Hawaii. C14-C20.

Cuddihy, L.W. and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. 138 pp.

Culliney, J.L. 1988. Islands in a far sea: nature and man in Hawaii. Sierra Club Books, San Francisco. 410 pp.

Department of Land and Natural Resources. 2002. Draft management plan for the ahupuaa of Puuwaawaa and the makai lands of Puuanahulu. State of Hawaii, Division of Forestry and Wildlife. P. 52.

Diong, C.H. 1982. Population biology and management of the feral pig (*Sus scrofa* L.) in Kipahulu Valley, Maui. Dissertation to the Zoology graduate division of the University of Hawaii. 408 pp.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guava* (common guava), forest weeds in Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 95. 105 pp.

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## **Approval/Concurrence:**

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted

12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

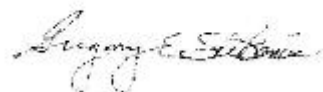
Approve:



06/01/2011

Date

Concur:



10/07/2011

Date

Did not concur:

\_\_\_\_\_

\_\_\_\_\_  
Date

Director's Remarks: